adopte dans ses travaux mathématiques surtout une attitude plus constructiviste qu'empiriste, si bien que malgré ses préoccupations physicalistes, Riemann pourrait être perçu comme un philosophe des sciences moderne dans la mesure où il exprime des vues qui anticipent sur le positivisme logique, et mieux, comme un contemporain de Peirce dont le concept d'abduction se rapproche singulièrement de la notion d'hypothèse au sens de Riemann.

Je veux montrer en particulier que la genèse du concept d'élément linéaire $ds = \quad dx^{2}$ (métrique sur une variété différentielle avec structure pseudo-riemannienne) obéit à la logique de la notion d'hypothèse dans son acception riemannienne. Les successeurs de Riemann , Helmholtz et Lie, ne s'y sont pas trompés qui prolongeront ses travaux arithmético-géométriques dans le même esprit et Hermann Weyl ne manquera pas de marquer la continuité des travaux du mathématicien Riemann avec les préoccupations fondationnelles qu'il a lui-même défendues tant du côté de la philosophie que du côté des mathématiques et de la physique.

Références

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Norma Goethe

Frege's Account of a Legitimate Inferential Procedure and the issue of Proofs by Contradiction

According to Frege, a proof does not only serve to convince us of the truth of what is proved, but it also serves to reveal the logical relations between truths. Thus, he insisted that logical inferences must proceed from true grounds to consequences. Accordingly, he consistently rejected the legitimacy of deriving a consequence from a mere supposition. As Dummett points out, Frege's insistence on proceeding from truths to truths determined the axiomatic developments of logic. But, perhaps more importantly, Frege's account of a legitimate inferential procedure seems to exclude indirect proofs or proofs by contradiction, a fact which would make him join a long epistemological tradition in the theory of demonstration which values insight into the network of inferences or the *grounds* for the acceptance of a truth over the certainty afforded by a proof.

Breaking with this tradition, Kant sought to characterize the difference between mathematics and philosophy by the difference in the methods of proof they employ and, in order to prevent the antimonies of pure reason, excluded proofs by contradiction from the latter. Kant argued that their real home was in mathematics.

In contrast, according to Frege, if one counts logic as part of philosophy, the history of these sciences teaches us that there is a close bond between mathematics and philosophy. Also in mathematics there is a risk that the law of contradiction may fail, as the set theoretic antinomies show.

Frege argues that we make far too much of the peculiarity of indirect proofs vis-à-vis direct proofs, for the difference between them is 'not at all important', once we see that there are some necessary preconditions for the application of the excluded middle and proofs by contradiction.

The paper addresses the issue of Frege's reduction of such types of proof to direct proofs as well as some of its philosophical consequences.

Ravi Gomatam

Einstein's Critique of Quantum Theory - A Reassessment

Einstein is well known for questioning whether quantum theory (QT) provided a complete description of the individual system. This has led in turn to the widespread notion that Einstein envisioned completing QT from within by adding to its state description. Perhaps in a clear recognition that the rhetoric of completeness had been infelicitous, Einstein himself wrote as late as in 1949: "the testable relations which are contained in it, are, within the natural limits fixed by the indeterminacy-relation, *complete*." [Einstein's emphasis]

Taking three of Einstein's arguments, all involving thought experiments - the time of decay of a single radioactive atom, the "ink mark on the paper" argument and the EPR argument - we shall propose that Einstein's overall charge against QT viewed as a theory of the individual system is better seen as *inconsistency,* rather than incompleteness. That is to say, if taken as providing a description of the 'real' state of the individual system, QT is inconsistent. For example, QT permits the idea of a definite time of detection (ToD) of a particle (that is emitted as a result of the decay of an atom) while ruling out an idea presupposed by ToD (namely, a definite time of decay of the atom). In Einstein's view, even the consequences of nonlocality and inseparability are only due to relating the psi function to the individual system.

To avoid the inconsistencies, the options Einstein considered were *not* completeness versus incompleteness of description of the individual system, but complete of description of an *individual* system versus complete description of an *ensemble* of systems. Based on the latter view, Einstein did in fact provide in 1936, a 'holist' interpretation of QT that, he claimed, adequately disposed of the EPR argument, a point not sufficiently recognized in the literature thus far. The key idea behind his interpretation is that the psi function represents neither the absolute state of an individual system nor an average state of an ensemble of systems, but a state of the ensemble treated as a *single epistemic whole*. He endeavored to show how this state conception has proved to be predictively complete.

A truly complete theory in physics, however, must also provide a conception of the measurement-independent state of the *individual system*. Einstein based this stance on his view of scientific realism, wherein he proposed the need for developing a new "object conception" in everyday thinking that would be appropriate to guide quantum physical thinking. Thus, a complete theory (describing the individual system) need not necessarily feature locality and/or separability (since it would involve altogether new object concepts) as much as it would supply a consistent description. If we are right, Einstein's critique may yet have some useful insights for the ongoing efforts to ascertain the realist content of quantum theory.

William Goodwin

Intuition and Reductio Proofs in Kant's Philosophy of Geometry

The nature of Kant's appeal to pure intuition in geometry is a much debated aspect of his philosophy of mathematics; however, one consequence of this appeal which has been generally accepted is that the constructability of a concept in intuition is a necessary condition for one to have synthetic knowledge involving that concept. The idea that constructability-in-intuition is a necessary feature of geometrical concepts which figure in legitimate knowledge claims is appealing for several reasons. First, this constraint on geometrical knowledge seems to be a natural specification of Kant's Principle of Significance; that is, the claim that all concepts which figure in objectively valid judgments must relate to empirical intuitions. Furthermore, the constructability of mathematical concepts plays an essential role in Kant's explanation of the success of the mathematical method, for instance he says, "mathematical knowledge is knowledge gained by reason from the construction of concepts" (A 713, B 741). Lastly, if Kant's notion of constructability-in-intuition is assimilated to the Euclidean notion of the constructability of geometrical objects, then Kant's use of constructability as a constraint on knowledge harmonizes with the Euclidean emphasis on the constructability of geometrical figures.

Another feature of Kant's philosophy of mathematics that has received less attention than his appeal to intuition is his endorsement of reductio reasoning in mathematical proofs. Because reasoning in reductio contexts seems to require inferences from inconsistent sets of premises, it is not clear how, or if, judgments entertained in such contexts can be parsed such that their subject concepts are consistent. In Euclidean reductio proofs, one is often required to infer that non-constructible figures have certain properties that turn out to be incompatible (see, for instance, Euclid I.6). The most natural reading of these Euclidean proofs would be that they require one to make synthetic judgments whose subject concepts are not constructible (in the Euclidean sense). Thus, if Kant's constructability-in-intuition requirement is assimilated to Euclidean construction, that is, if a concept is constructible in intuition only if an instance of it can be constructed by ruler and compass, then Kant would be ruling out a form of geometrical reasoning which he seems to endorse.

In this paper, I will explore several options for reconciling the apparent conflict between these aspects of Kant's Philosophy of Geometry.

Geoff Gorham

The Metaphysical Roots of Cartesian Physics: The Law of Rectilinear Motion

According to Descartes' famous tree metaphor, metaphysics is to physics as roots are to trunk. In this paper, I attempt to uncover the metaphysical roots of Descartes' second law of motion ('all motion is in itself rectilinear'). Descartes says that the reason for the second law is just the same as the reason for the others: God continuously preserves the world, along with all its motions and transfers of motion, by the identical operation as when he first created it. In outline, his argument from the immutability of divine preservation to rectilinear motion is as follows. God preserves motion 'in the exact form in which it is occurring at the very instant he preserves it, without taking account of any earlier motion.' At any instant, God can only preserve a tendency to move along a straight line. Hence, an immutable God preserves rectilinear motion over time. (AT VIIIA 63-4, AT XI 44-5) What remains for modern commentators to explain is why God